REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	Changes in accordance with NOR-5945-R002-93	26 Feb 93	D. E. Moore
B	Added source CAGE 0SNN5. Changed CAGE 63745 to CAGE 16170. PIN's 89116-001, 89116-003, and 89116-005 are obsolete. Editorial changes throughout.	19 Apr 94	D. Moore
C	Changes in accordance with NOR 5945-R003-98.	15 Apr 98	D. Moore
D	Validation and update. Added source CAGE 58614.	25 Jul 03	K. Cottongim
E	Revised document to add vendor 18741 as an approved source. Editorial changes made throughout.	14 Feb 08	Michael A. Radecki
F	Revised document to list eligible approved sources. Editorial changes made.	22 Dec 25	Mark A. Rush

CURRENT DESIGN ACTIVITY CAGE CODE 037Z3
DEFENSE LOGISTICS AGENCY
DEFENSE SUPPLY CENTER COLUMBUS
COLUMBUS, OHIO 43218-3990

Prepared in accordance with ASME Y14.100

Source control drawing

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REV STATUS OF PAGES	**REV**		F	F	F	F	F	F	F	F	F	F	F	F	F						
	PAGES		1	2	3	4	5	6	7	8	9	10	11	12	13						

PMIC N/A	**PREPARED BY** Tony J. Westphal	**DESIGN ACTIVITY** **DEFENSE ELECTRONICS SUPPLY CENTER** **DAYTON, OH 45444-5000**
Original date of drawing 30 November 1990	**CHECKED BY** Charles R. DeVaul **APPROVED BY** Randy Larson	**TITLE:** RELAY, SOLID STATE, HERMETICALLY SEALED, OPTICALLY ISOLATED, 0.25 TO 1.0 AMPERE, ±80 V DC TO ±350 V DC, ANALOG SIGNAL SWITCHING, SPST (NO), TTL CONTROL INPUTS
	SIZE A / **CODE IDENT. NO.** 14933	**DWG NO.** 89116
	REV F	**PAGE** 1 **OF** 13

AMSC N/A

5945-2026-E01

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1. SCOPE

1.1 Scope. This drawing establishes the requirements for a sealed, solid state, hermetically sealed relay, supplied to the Y screening requirements of MIL-PRF-28750.

1.2 Part or Identifying Number (PIN). The complete PIN shall be as follows:

89116	-002
Drawing number	Dash number (see table I)

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this drawing. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents in sections 3 and 4 of this drawing, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-28750	-	Relays, Solid State, General Specification for
MIL-STD-31000	-	Technical Data Packages

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-202	-	Electronic and Electrical Component Parts
MIL-STD-883	-	Microcircuits

(Copies of these documents are available online at https://quicksearch.dla.mil.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Drawing precedence. This drawing takes precedence over documents referred to herein and shall be interpreted in accordance with MIL-STD-31000.

3.2 Item requirements. The individual item requirements shall be in accordance with MIL-PRF-28750, and as specified herein.

3.2.1 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-28750, and herein (see figure 1).

3.3 Electrical characteristics. Unless otherwise specified, ambient temperature for electrical characteristics shall be -55°C to +120°C.

3.3.1 Input and output characteristics. See table I.

3.3.2 Insulation resistance. Insulation resistance shall be in accordance with MIL-PRF-28750, except the resistance shall be 1,000 megohms minimum at 500 V dc.

3.3.3 Isolation (input-to-output). Isolation (input-to-output) shall be 5 pF maximum.

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3.3.4 Power dissipation. Power dissipation shall be 1 watt maximum.

3.4 Environmental characteristics.

3.4.1 Operating temperature range. Operating temperature range shall be -55°C to +120°C (see figure 2, configuration A for PIN 89116-002, configuration B for PIN 89116-004, and configuration C for PIN 89116-006 for derating curves).

3.4.2 Storage temperature range. Storage temperature range shall be -55°C to +125°C.

3.4.3 Shock. Shock shall be in accordance with MIL-PRF-28750.

3.4.4 Vibration. Vibration shall be in accordance with MIL-PRF-28750.

3.4.5 Acceleration. Acceleration shall be in accordance with MIL-STD-883, method 2001, test condition A, 5,000 G's, Y1 axis.

3.4.6 Seal (hermetic). Seal shall be in accordance with MIL-PRF-28750.

3.5 Physical requirements. Physical requirements shall be as specified in figure 1.

3.5.1 Weight. Weight shall be 2 grams (0.07 ounce) maximum.

3.5.2 Wiring diagram. See figure 5 and figure 6.

3.5.3 Case. Grade A nickel, six-pin dual-in-line package.

3.5.4 Pins and header. Kovar gold plated in accordance with MIL-PRF-28750.

3.6 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.7 Manufacturer eligibility. To be eligible for listing as an approved source of supply, a manufacturer shall be listed on the MIL-PRF- 28750 Qualified Product List for at least one part, or perform the group A and group C inspection specified herein on a sample of parts agreed upon by the manufacturer and DSCC-VA.

3.8 Certificate of compliance. A certificate of compliance shall be required from manufacturers requesting to be an approved source of supply. The certificate shall state that the manufacturer's product meets all the requirements of this drawing.

3.9 Pure tin. The use of pure tin, as an underplate or final finish is prohibited both internally and externally. Tin content of resistor components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see 6.4).

3.10 Marking. Marking shall be in accordance with MIL-PRF-28750, except the relay shall be marked with the PIN as specified herein (see 1.2), the manufacturer's name or Commercial and Government Entity (CAGE) code, and date lot codes. The "M28750/X-XXXY" PIN shall not be used.

3.11 Workmanship. The relay shall be uniform in quality and free from any defects that will affect life, serviceability, or appearance.

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TABLE I. Input and output characteristics. 1/ 2/ 3/ 4/

Input characteristics			
LED input current	50 mA maximum (-55°C to +105°C) 5/ 25 mA maximum (+105°C to +120°C) 6/		
Rated LED input current	25 mA 5/ 6/ 7/		
Turn-on current (assured)	10 mA minimum 5/ 6/ 7/		
Turn-off current (assured)	10 μA maximum		
Turn-off voltage (assured)	1.5 V dc maximum		
Input voltage drop	3.25 V dc maximum at 25 mA		
Reverse polarity (bias) 8/	-5 V dc maximum at $I_R \leq 100$ μA		
Output characteristics			
	89116-002	89116-004	89116-006
Output voltage	± 180 V dc maximum	± 350 V dc maximum	± 80 V dc maximum
Output voltage drop Series I_{IN} = 25 mA 7/ Parallel	1.00 V dc maximum 0.50 V dc maximum (see figure 2, configuration A, for load current)	2.40 V dc maximum 1.80 V dc maximum (see figure 2, configuration B, for load current)	0.75 V dc maximum 0.40 V dc maximum (see figure 2, configuration C, for load current)
Output leakage current Series (+25°C to +120°C) Parallel Input: 1.5 V dc	20 μA maximum 40 μA maximum Load: ±180 V	20 μA maximum 40 μA maximum Load: ±350 V	20 μA maximum 40 μA maximum Load: ±80 V
(-55°C to +25°C) Series Input: 1.5 V dc Parallel	200 nA maximum 400 nA maximum Load: ±180 V (limited to 0.50 A)	200 nA maximum 400 nA maximum Load: ±350 V (limited to 250 mA)	200 nA maximum 400 nA maximum Load: ±80 V (limited to 1.0 A)
Load current 9/	See figure 2, configuration A	See figure 2, configuration B	See figure 2, configuration C
ON resistance Series I_{IN} = 25 mA Parallel 7/ 10/	1.0 Ω maximum 0.25 Ω maximum load current = ±100 mA	8.0 Ω maximum 2.0 Ω maximum load current = ±10 mA	0.6 Ω maximum 0.15 Ω maximum load current = ±100 mA
Overload 1 Hz, 10 percent maximum duty cycle (on time) 10 cycles maximum, I_{IN} = 25 mA 7/	3.5 x rated current (see figure 2, configuration A)	3.5 x rated current (see figure 2, configuration B)	3.5 x rated current (see figure 2, configuration C)

See footnotes at end of table.

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TABLE I. Input and output characteristics - Continued. 1/ 2/ 3/ 4/

Output characteristics			
	89116-002	89116-004	89116-006
Turn-on time (see figure 3) I_{IN} = 25 mA 7/	800 µs maximum, load: ±180 V, load current, see figure 2, configuration A, for derating curve	500 µs maximum, load: ±350 V, load current, see figure 2, configuration B, for derating curve	800 µs maximum, load: ±80 V, load current, see figure 2, configuration C, for derating curve
Turn-off time (see figure 3) I_{IN} = 25 mA 7/	500 µs maximum, load: ±180 V, load current, see figure 2, configuration A, for derating curve	500 µs maximum, load: ±350 V, load current, see figure 2, configuration B, for derating curve	500 µs maximum, load: ±80 V, load current, see figure 2, configuration C, for derating curve
DC transient voltage (1 mA maximum leakage, 5 seconds maximum)	±180 V dc maximum	±360 V dc maximum	±90 V dc maximum
Exponential rate of voltage rise (dv/dt)	100 V/µs	100 V/µs	100 V/µs
Dielectric withstanding voltage 60 Hz, 1 mA maximum (input to output and all pins to case)	500 V ac	500 V ac	500 V ac
EMI	Applicable	Applicable	Applicable
Zero crossover	Not applicable	Not applicable	Not applicable
Minimum current	Not applicable	Not applicable	Not applicable
DC offset voltage (see figure 4) I_{IN} = 25 mA 7/	100 µV dc maximum	100 µV dc maximum	100 µV dc maximum

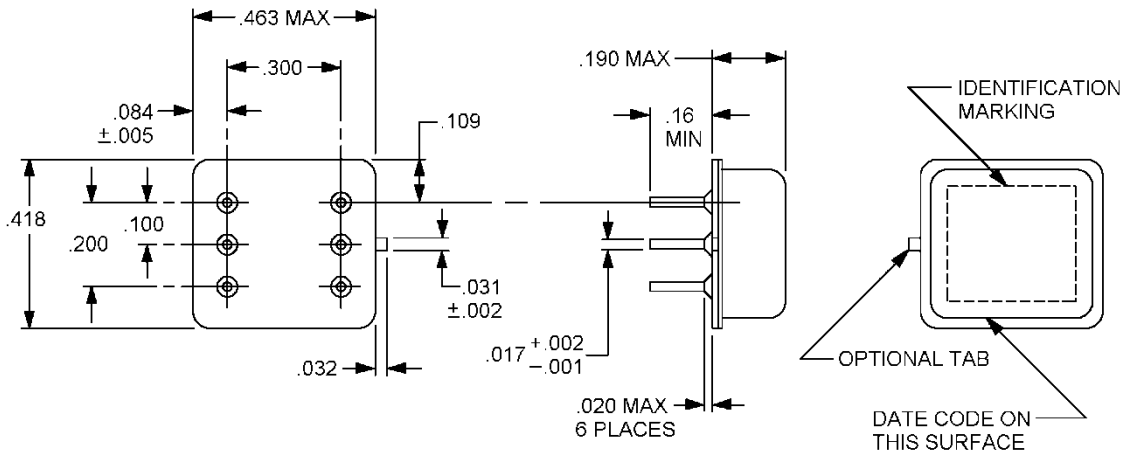
1/ Relays may drive loads connected to either positive or negative reference power supply lines.
2/ Inductive loads must be diode suppressed.
3/ Input transitions should be 1 ms or less.
4/ Acceptance testing is accomplished in the series mode (output current flows at terminals 4 and 6).
5/ Unless otherwise noted, parametric testing accomplished at 25 mA input current.
6/ Resistor must be in series with input at all times.
7/ Input current approximation:

$$I_{IN} = \frac{V_{IN} - LED\ drop}{R_S}$$

Average LED voltage drops are (25 mA):
3.0 V at -55°C
2.7 V at +25°C
2.4 V at +120°C

8/ Reverse input voltage of more than 5 volts may cause permanent damage.
9/ Continuous load current is rated under the condition of still air.
10/ Formula for on resistance at junction temperature greater than +25°C:
R_T = (R at +25°C)(e^x)
Where X = .0072 T_J - 25°C for 89116-004 and
X = .0065 T_J - 25°C for 89116-002 and 89116-006.

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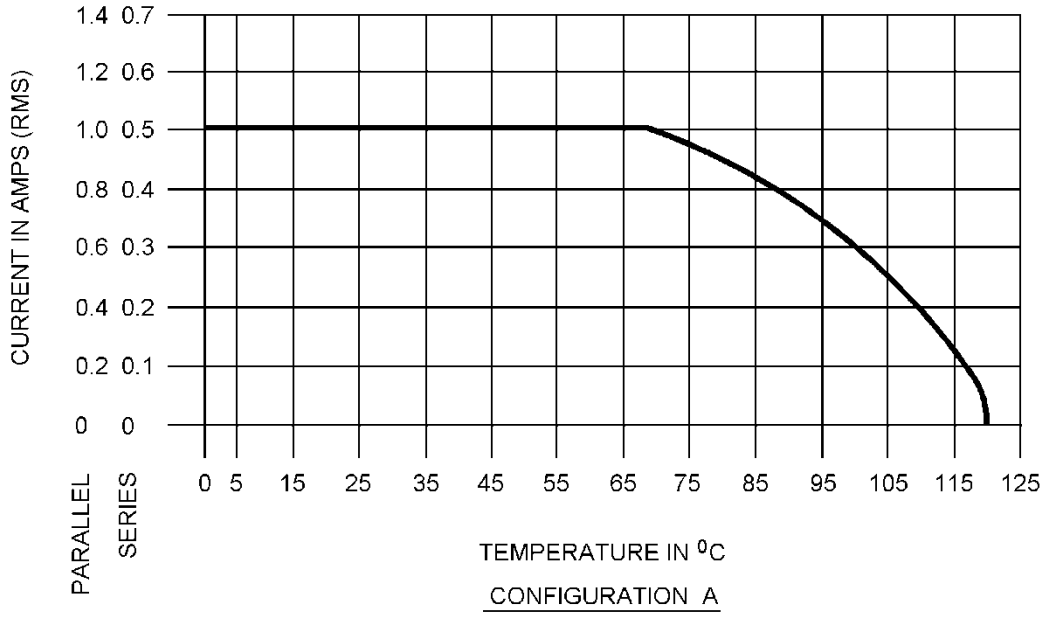


Inches	mm
.001	0.03
.002	0.05
.005	0.13
.017	0.43
.020	0.51
.031	0.79
.032	0.81
.079	2.01
.100	2.54
.109	2.77
.190	4.83
.200	5.08
.418	10.62
.70	17.8

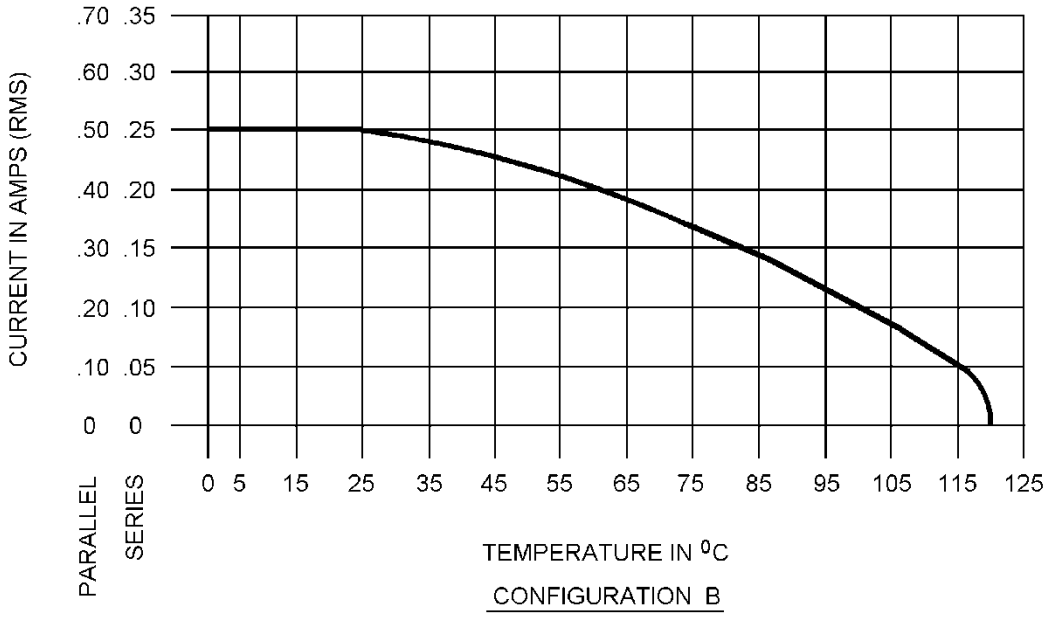
NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is ±.005 (0.13 mm) for three-place decimals and ±.01 (0.3 mm) for two place decimals.

FIGURE 1. Outline drawing and dimensions.

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(For 89116-002)



(For 89116-004)

FIGURE 2. Ambient derating curve for load current.

DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO	SIZE A	CODE IDENT NO. 14933	DWG NO. 89116
		REV F	PAGE 7

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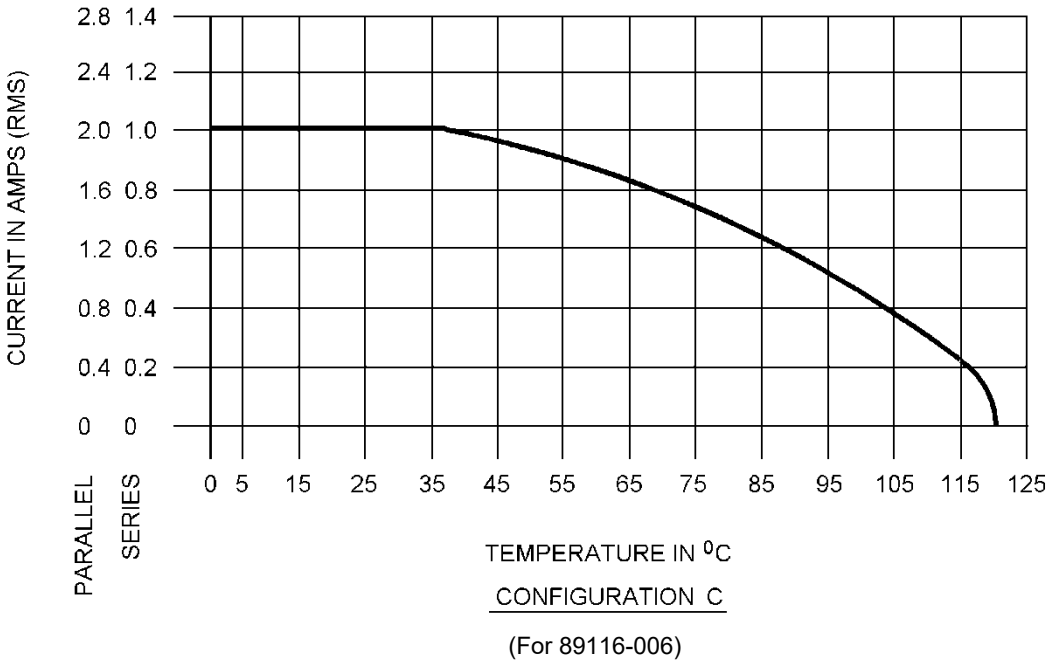


FIGURE 2. Ambient derating curve for load current - Continued.

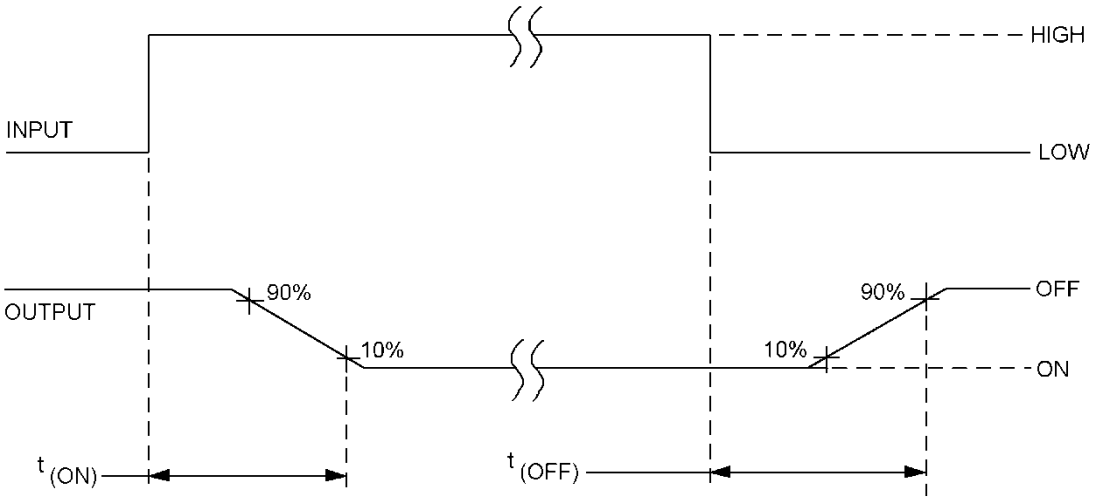
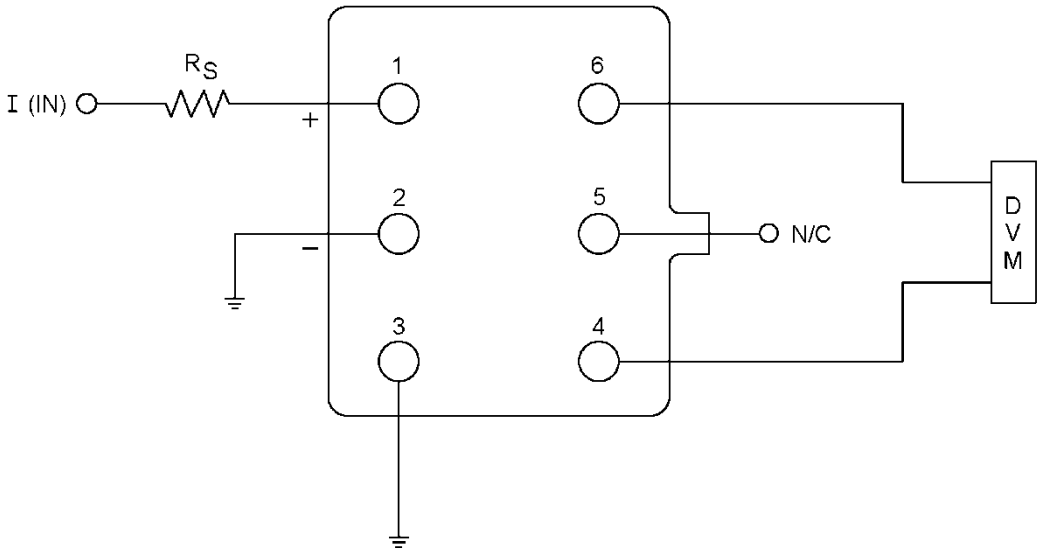


FIGURE 3. Turn-on and turn-off timing.

DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO	SIZE A	CODE IDENT NO. 14933	DWG NO. 89116
		REV F	PAGE 8

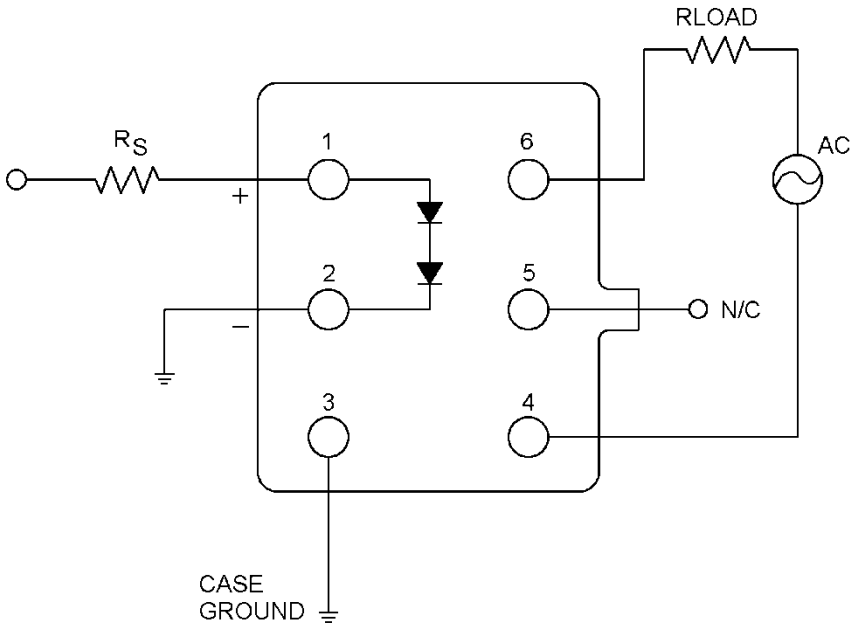
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$I_{(IN)}$ = 25 mA (see footnote 7/ of table I)
No output voltage or current applied

FIGURE 4. Test circuit for dc offset voltage measurement.

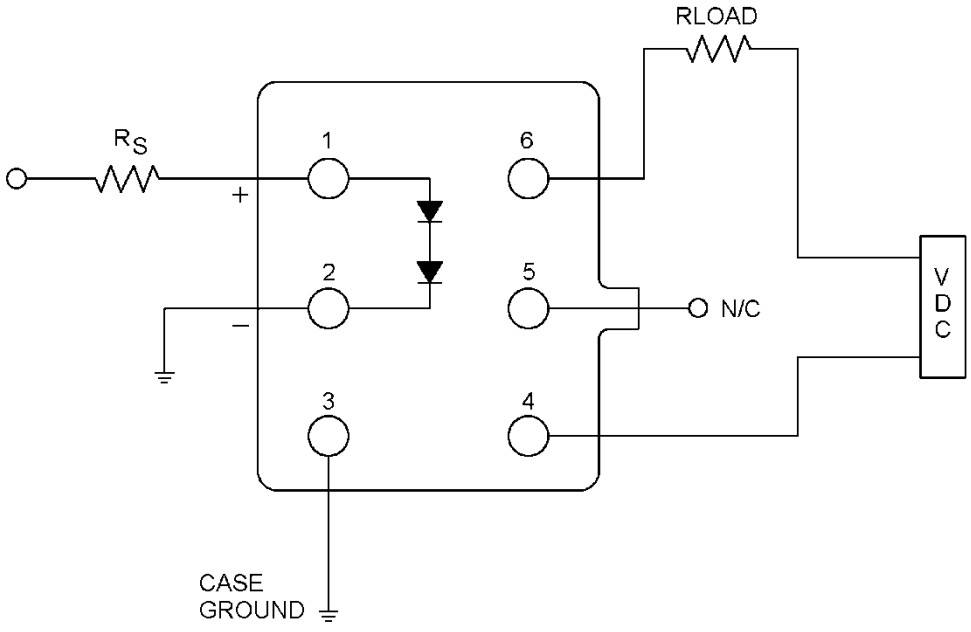
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±180 V peak - 89116-002

±350 V peak - 89116-004

±80 V peak - 89116-006



±180 V - 89116-002

±350 V - 89116-004

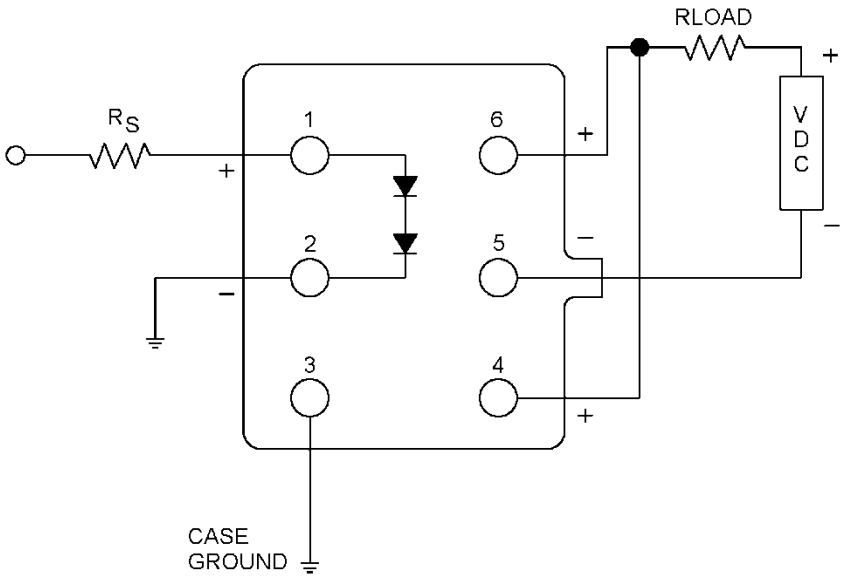
±80 V - 89116-006

NOTE: Series-connected relays are for ac or dc applications.

FIGURE 5. Series-connected wiring diagram.

DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO	SIZE A	CODE IDENT NO. 14933	DWG NO. 89116
		REV F	PAGE 10

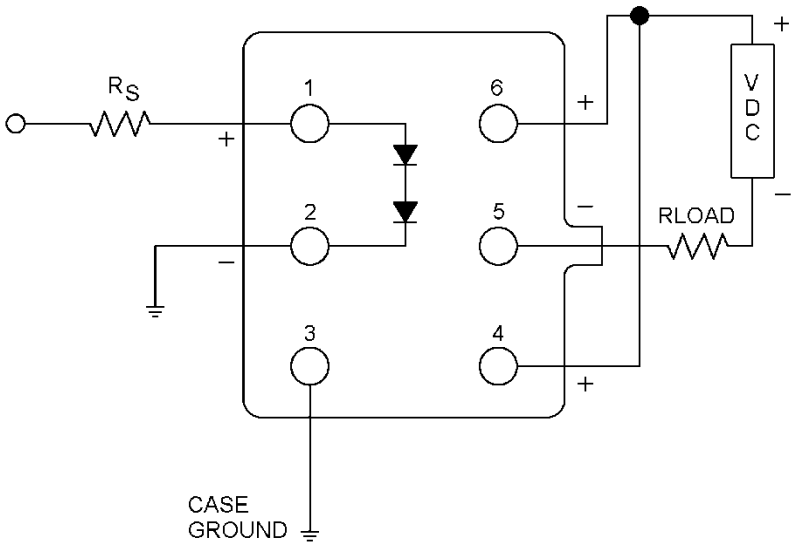
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180 V - 89116-002

350 V - 89116-004

80 V - 89116-006



180 V - 89116-002

350 V - 89116-004

80 V - 89116-006

NOTE: Parallel-connected relays are for dc applications only. They have twice the current and leakage ratings at one-fourth the on-resistance of the series connection.

FIGURE 6. Parallel-connected wiring diagrams.

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4. VERIFICATION

4.1 Product assurance program. The product assurance program specified in MIL-PRF-28750 is not applicable to this document.

4.2 Statistical process control. The statistical process control program specified in MIL-PRF-28750 is not applicable to this document.

4.3 Conformance inspection.

4.3.1 Inspection of product for delivery. Inspection of product delivery shall consist of the group A inspections of MIL-PRF-28750 for the Y screening level. Group A testing shall be performed on each inspection lot and manufacturers shall keep lot records for 3 years (minimum), monitor for compliance to the prescribed procedures, and records on lots are maintained for these relays. Components used internally to the relay shall not require hermetic packaging. Temperature range for screening tests shall be as specified in 3.3 herein.

4.3.2 Inspection of packaging. Inspection of packaging shall be in accordance with MIL-PRF-28750.

4.4 Methods of inspection. Methods of inspection shall be in accordance with MIL-PRF-28750.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.3). When packaging of materiel is to be performed by DoD personnel or in-house contractor personnel, these personnel need to contact the packaging activity responsible to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the person responsible for packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful but is not mandatory.)

6.1 Notes. Only definitions of the notes specified in MIL-PRF-28750 will apply to this drawing.

6.2 Intended use. Relays conforming to this drawing are intended for use when military specifications do not exist and qualified military devices that will perform the required function are not available for OEM application. This drawing is intended exclusively to prevent the proliferation of unnecessary duplicate specifications, drawings, and stock catalog listings. When a military specification exists and the product covered by this drawing has been qualified for listing on QPL-28750, this drawing will become inactive for new design. The QPL-28750 product shall be the preferred item for all applications.

6.3 Ordering data. The contract or purchase order should specify the following:

a. Complete PIN (see 1.2).

b. Requirements for delivery of one copy of the conformance inspection data or certificate of compliance that parts have passed conformance inspection with each shipment of parts by the manufacturer.

c. Requirements for packaging and packing.

6.4 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers. For additional information on this matter, refer to ASTM-B545 (Standard Specification for Electrodeposited Coatings of Tin).

6.5 Replaceability. Relays covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

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6.6 Users of record. Coordination of this document for future revisions is coordinated only with the approved sources of supply and the users of record of this document. Requests to be added as a recorded user of this drawing should be in writing to: Defense Supply Center, Columbus, ATTN: DSCC/VAT, Post Office Box 3990, Columbus, OH 43218-3990 or by telephone (614) 693-0122 or DSN (392) 693-0122.

6.7 Approved source(s) of supply. Approved source(s) of supply are listed herein. Additional sources will be added as they become available. Assistance in the use of this drawing may be obtained online at mailto:relay@dscc.dla.mil, or by contacting Defense Supply Center, Columbus, ATTN: DSCC-VAT, Post Office Box 3990, Columbus, OH 43218-3990 or by telephone (614) 693-0122 or DSN (392) 693-0122.

DSCC drawing PIN	Vendor similar designation or type number 1/	Vendor CAGE	Vendor name and address
89116-002 89116-004 89116-006	FB00FCY(C66-1Y) FB00KBY(C66-2Y) FB00CDY(C66-3Y)	11532 2/	Teledyne Relays 12525 Daphne Avenue Hawthorne, CA 90250-3308 Phone: (323) 777-0077
89116-002 89116-004 89116-006	53123Y 53119Y 53122Y	31757	Micropac Industries, Inc. 1655 State Hwy 66 Garland, TX/ 75040 6705 Phone: (972) 272-3571
89116-002 89116-004 89116-006	CT-102Y CT-103Y CT-101Y	31338	Semitronics Corporation 80 Commercial Street Freeport, NY 11520-2832 Plant: 64 Commercial Street Freeport, NY 11520-2832 Phone (516) 623-9400
89116-002 89116-004 89116-006	MS18-1002 MS18-1004 MS18-1006	58614	TE Connectivity Corporation 1396 Charlotte Highway Fairview, NC 28730-1409 Phone: (800) 806-0480

1/ Parts must be purchased to the DSCC PIN to assure that all performance requirements and tests are met.

2/ The vendor PIN shown in the parentheses is the obsolete PIN format for subject item, and is shown for traceability and reference only.

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